

## 615-0335 (10-152) Lenz's Law Pendulum

**Introduction:** What is Lenz's Law? How does it apply to pendulums? Lenz's Law gives the direction of the electromotive force caused by electromagnetic induction. Electromagnetic induction is a phenomenon caused when a magnetic field interacts with a conductive material. As the material passes through the magnetic field, electrons in the conductor become excited by the magnet. If the field is strong enough, they gain sufficient energy to flow from one atom to the next. This causes an electrical current, or induced current. Since electricity and magnetism are closely related, these pockets of electricity become small electromagnets, called eddy currents. Lenz's Law states that the polarity of this induced current must be opposite to the polarity of the magnetic field; otherwise, it would violate the law of conservation of energy. The effect of this law is that a nonmagnetic, conductive material can be affected by a magnetic field. As the magnet induces current, the eddy currents act as electromagnets, and attract the magnet, in accordance with Lenz's law.



Note: this effect applies only for moving conductors. It is the motion that causes the induced current. Simply putting a magnet on a stationary conductor will not produce eddy currents.

**Description:** Our set provides a graphic example of Lenz's Law. It consists of an upright wooden block connected to a base, with a powerful neodymium magnet mounted perpendicularly on the base. The top contains a bolt with a matching thumbscrew. Also included are two aluminum plates that fit the bolt. One is a solid sheet of aluminum; the other is slotted.

**Operation:** Remove the thumbscrew from the bolt, place the slotted aluminum plate on the bolt, and tighten it into place. The bolt is designed to provide a low friction environment, allowing the aluminum plate to swing like a pendulum.

For this experiment, you will want a protractor and a stopwatch. Choose an angle and release the slotted aluminum plate from it. Time how long it takes for the plate to stop moving.

Next, place the solid aluminum plate on the bolt and secure it in place. Release it from the same angle you chose for the slotted plate. Time how long it takes to cease moving. You will find that the times are drastically different.

**Explanation:** to explain the discrepancies between the two times, we need to consider Lenz's law. Lenz's Law states that the polarity of induced current will be opposite to the polarity of the magnetic field present. In other words, a magnetic field causes a moving conductor to be magnetically active. In the case of the slotted plate, electrons were unable to flow across the gaps, meaning no eddy currents could form, and thus there was no interaction between the plate and the magnet. With the solid plate, the situation is reversed. Electrons could move freely throughout, which caused eddy currents to attract the magnet. This in turn caused an electromotive force which slowed the plate.

### **Warranty and Parts:**

We replace all defective or missing parts free of charge. Additional replacement parts may be ordered toll-free. We accept MasterCard, Visa, checks and School P.O.s. All products warranted to be free from defect for 90 days. Does not apply to accident, misuse or normal wear and tear. Intended for children 13 years of age and up. This item is not a toy. It may contain small parts that can be choking hazards. Adult supervision is required.

### **May we suggest:**

**615-0270 Magnetic Field Demonstration-2D:** Wow your students with this handy magnetic field demonstration! Shake the unit so that the iron filings are distributed throughout the unit. This transparent acrylic case holds iron filings in such a way as to maximize the visible lines of force from a magnet placed either on top of or underneath the case. Note: Magnets not included.